**South Delta Fisheries-Hydrodynamics Studies**

**Lenny Grimaldo (DWR)**

*Lead agencies:* USBR, USGS and DWR
*What:* This is an externally-funded (South Delta Barriers Project & USBR) IEP special study that was initiated in 2004. Its goal is to develop a theoretical baseline for understanding how larval fish behavior affects entrainment risk in the south Delta under differing hydrologic and operations scenarios.
*When:* The second phase of field data collection will be completed during spring 2005; a summary report should be available by the end of 2005
*Questions addressed:* What are the behaviors of larval fishes in the south Delta and how does behavior affect entrainment risk vary under different hydrologic (flows and exports) and operations (DCC, south delta barriers) scenarios? Do recent year summertime water operations have the potential to significantly increase mortality rates?

**Study Timeline**

- 2004 Conducted a successful pilot study to determine the appropriate methodology
- 2005 Conducted two 48 hour experiments in April and May (during VAMP)
- 2006 (April and May) Repeat field experiments during the same months using the same methodology.
- 2006 (June-Dec) Analyze physical data, dissect stomachs, send otoliths to UCD for analysis, have zooplankton identified, and prepare presentations for CALFED and/or IEP Asilomar. Work with USGS for particle tracking runs (?)
- June 2007 Prepare draft papers

**Summary of methods**

Zooplankton and fish larvae (505 µm mish used) were collected each hour for 48 hours straight at a near-field (first 24 hours) and far-field (second 24 hours) location (Figure 1).

- Three habitats were sampled each hour; edge, channel surface, and channel mid-depth (Figure 2)
- In situ chlorophyll and DOC measurements were made every 4 hours at each location
- Hydrodynamic profiles measured by USGS to examine flow and velocity contours across the channel
- Hydroacoustic profiles measured by USBR to examine fish mass movements in relation to fish and hydrodynamic sampling.
- Other variables measured each hour using a Sonde profiler: temperature, specific conductance, chlorophyll, DO, and turbidity
- Downloaded water inflow data for CCF gate openings and river inflow data from the web.

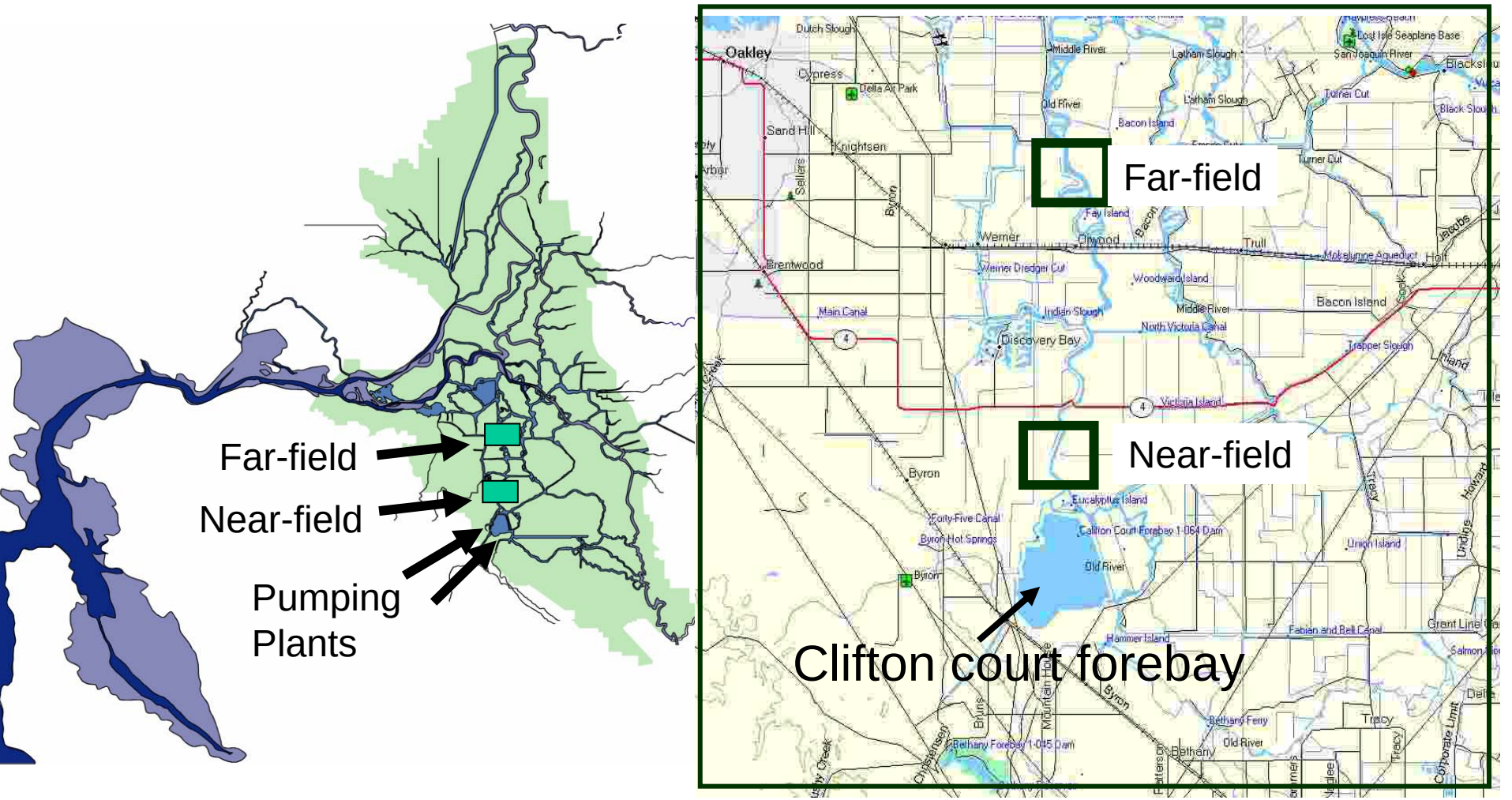
**Summary of results to date**

- Almost 300 zooplankton and larval fish samples were collected during the two experiments
- 1/3 of samples preserved in ethanol for otolith analysis (delta smelt only)
- Diets of larvae (all delta smelt, splittail, and subset of most abundant species) currently being examined
- Physical data from Sonde has been entered and analyzed.
    - In April, **water temp, turbidity and chlorophyll varied by habitat and tim**e (Figure 3)
    - In May, no real differences observed (Figure 4)
- In situ chlorophyll and DOC water samples have been processed by Bryte lab but not statistically analyzed of yet.
- About ¼ of the fish samples have been sorted and identified
    - ~ **12 delta smelt** counted to date
    - ~**16 splittail** counted to date
    - Prickly sculpin most abundant species thus far, centrarchids are a close second.
    - ~10 Sacramento blackfish also observed
- Pilot results show that **velocity profile exists in the Old River** Channel (Figure 5)
- Pilot fish results show that **larval fish vary by habitat (Figure 6) and time of day (Figure 7)**
- Expect to have 2005 fish habitat results analyzed by January 2006
- Expect to have 2005 diet results analyzed by March 2006
- Otolith samples will be delivered for analysis in July 2006

**Major issues to resolve**

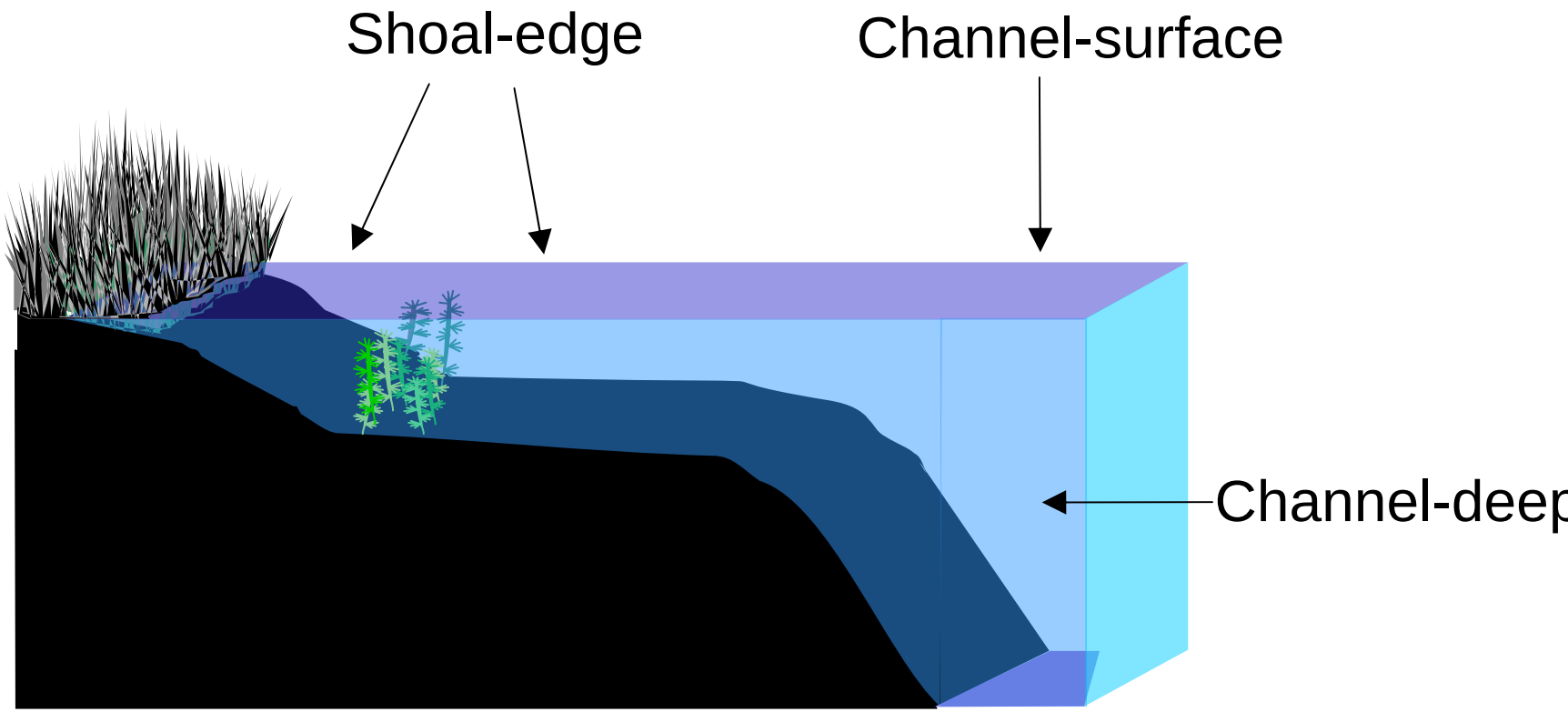
- Particle tracking model input runs using empirical data
- Zooplankton identification
- Awaiting Karl's group to design and create a multi-interfaced database

# Figure 1. Map



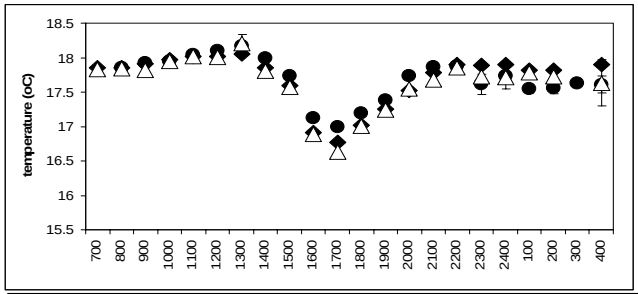

This is a draft work in progress subject to review and revision as information becomes available.

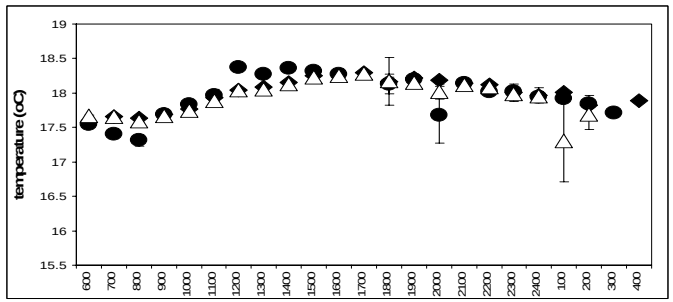
Figure 2. Habitats sampled

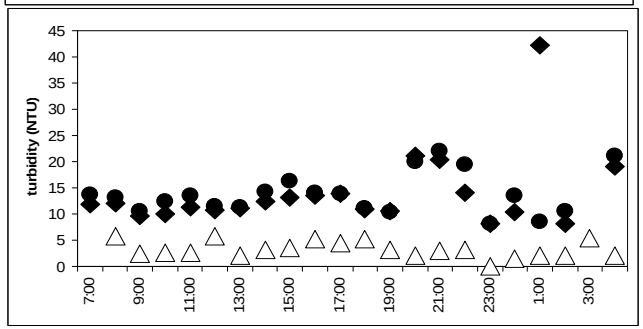


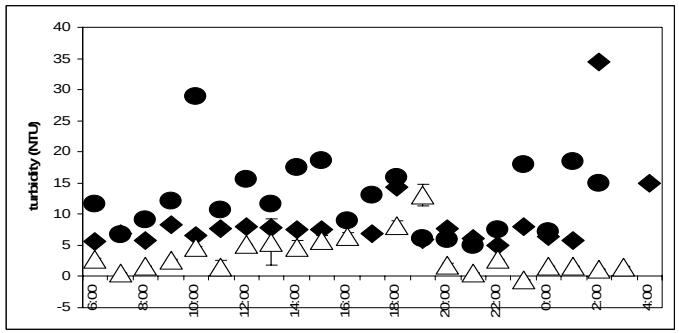
# Figure 3.

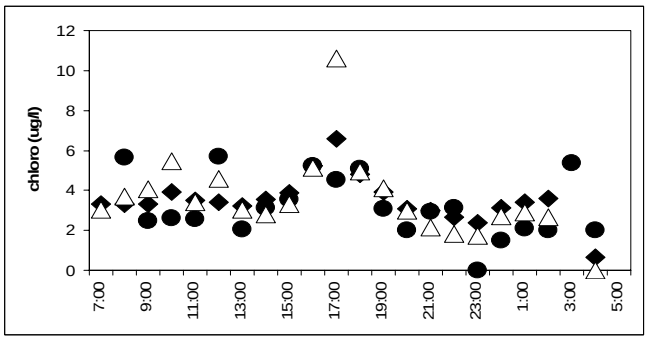
South Delta Fish 48 hr Studies-Physical variables by site and habitat
April 27-29, 2005

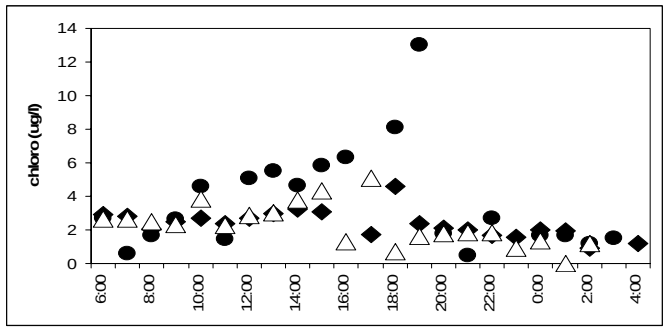


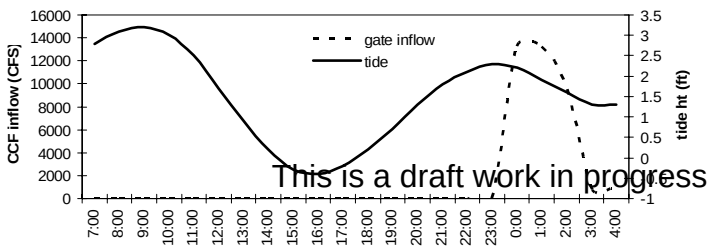



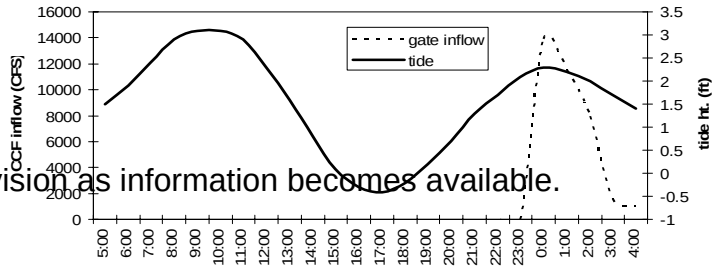



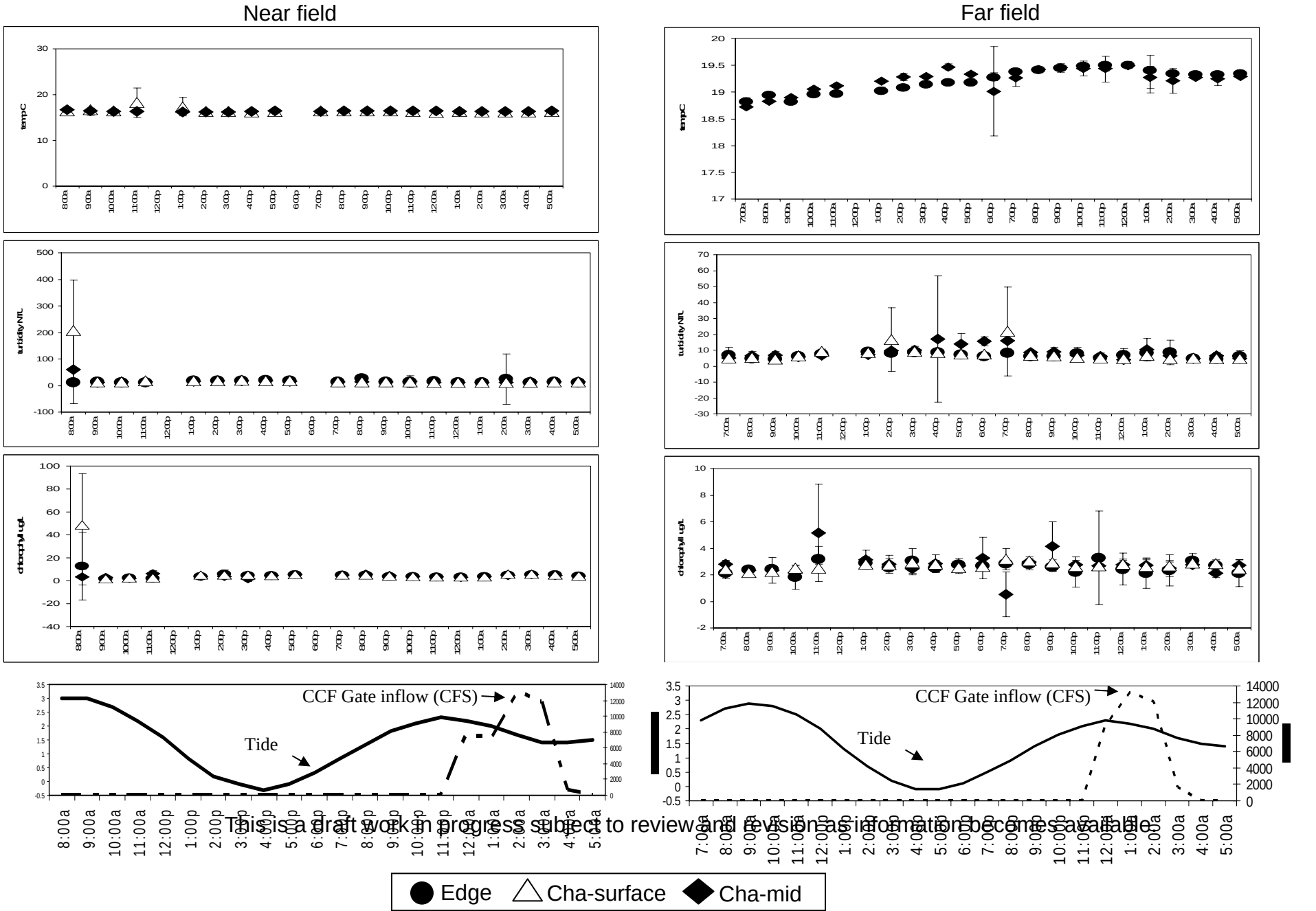



# Figure 4.

South Delta Fish 48 hr Studies-Physical variables by site and habitat
May 11-13, 2005



# Figure 5. Velocity Profiles (USGS)

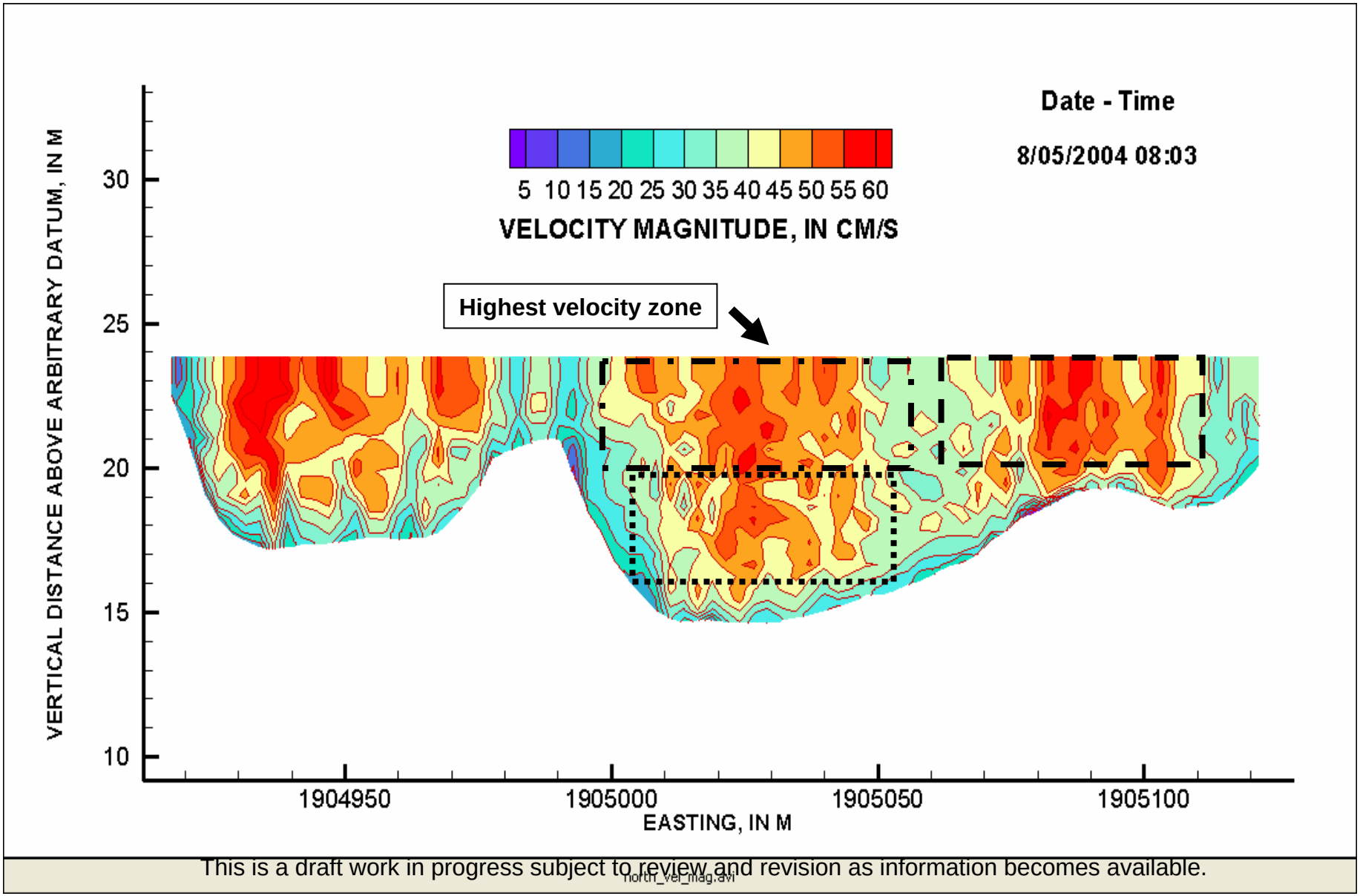
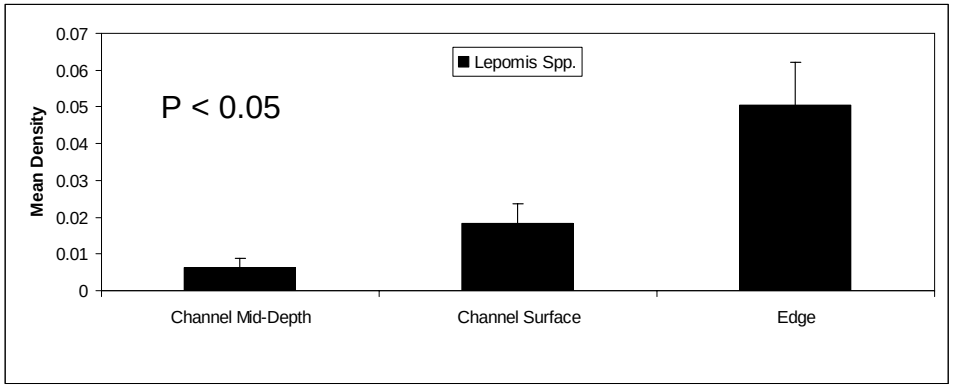
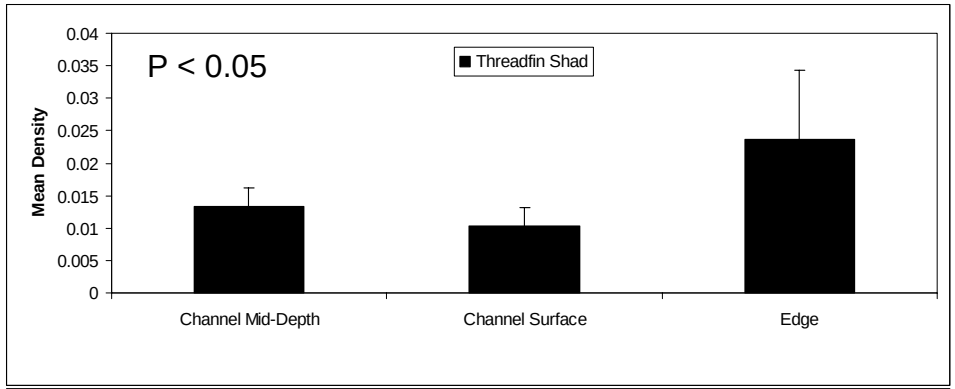
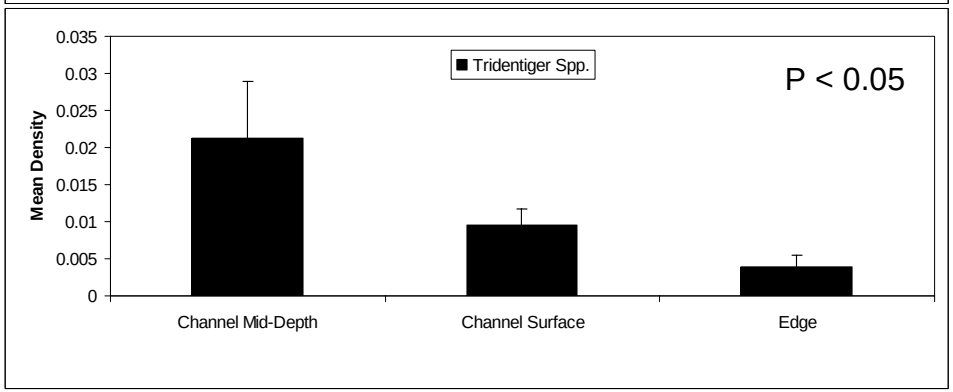


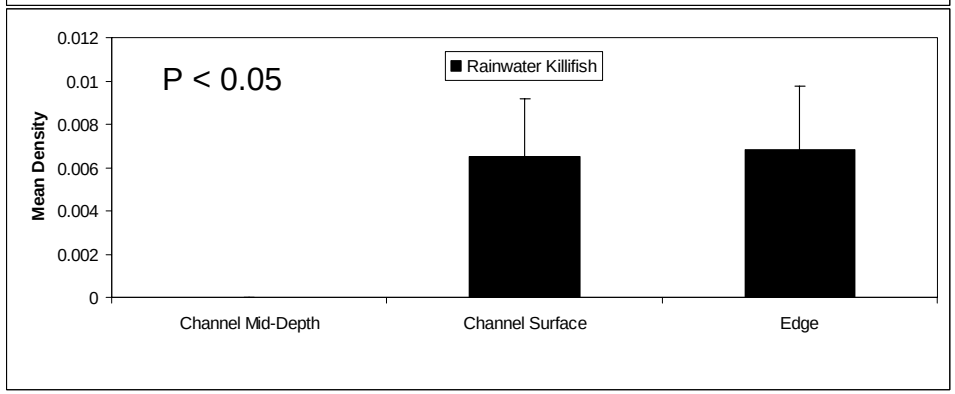
Figure 6.

# South Delta Fish Studies-Pilot results 2004



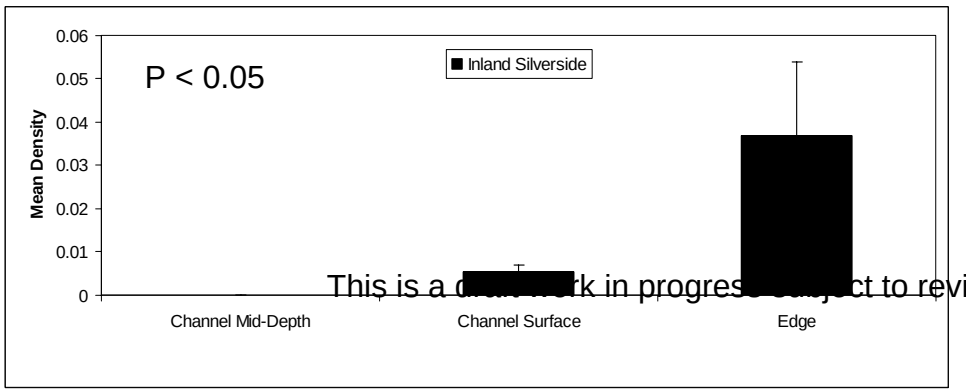




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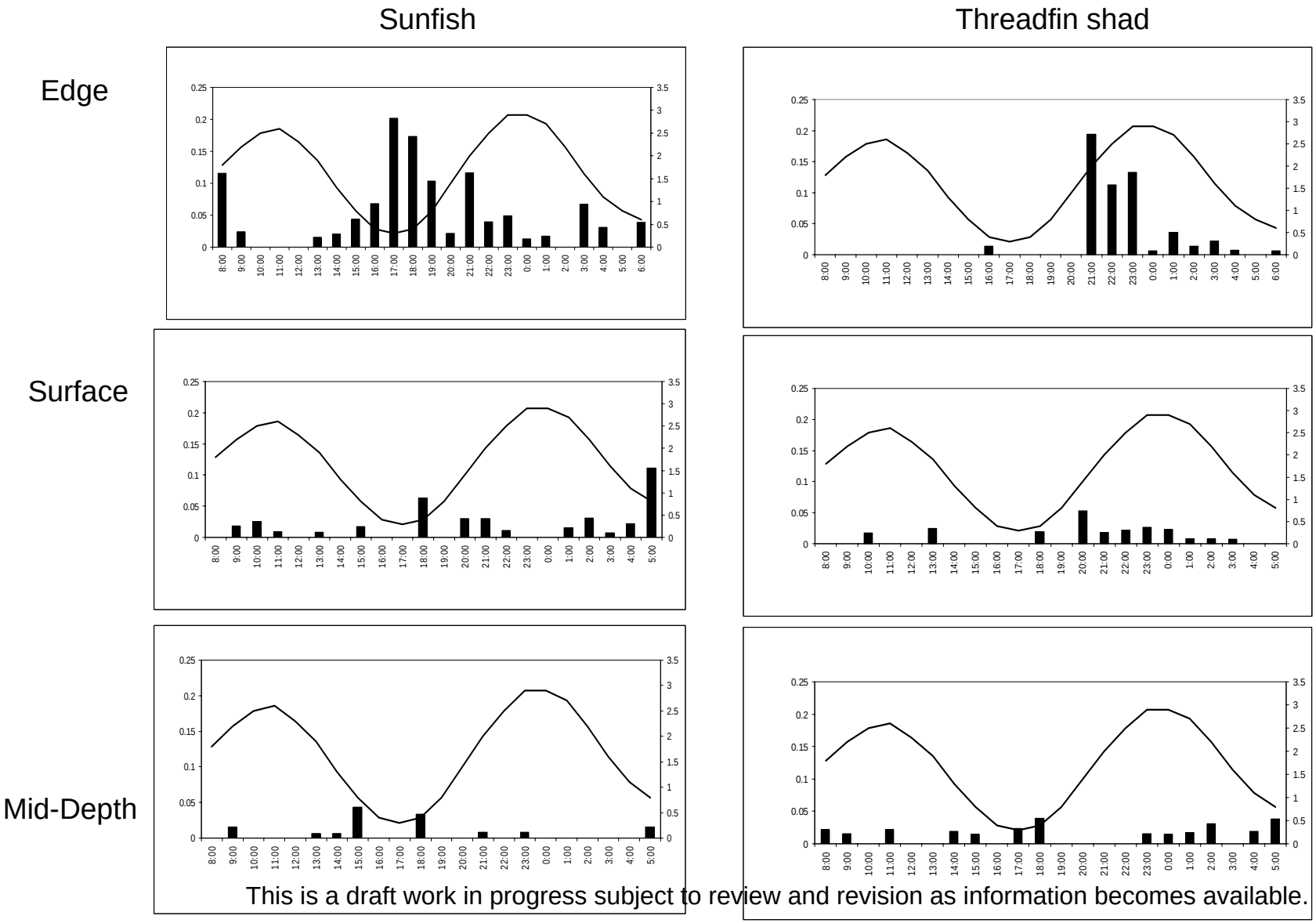
Figure 7.

# South Delta Fish Studies-2004 Pilot results

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Ho: Sunfish densities do not vary by time of day and habitat, ANOVA $P < 0.05$

Ho: TFS densities do not vary by time of day and habitat, ANOVA $P < 0.05$